

SHEET (2)
Entropy (A Measure of Disorder)

1- Suppose that 1 kg of saturated water vapor at 100 °C is condensed to saturated liquid at 100 °C in a constant-pressure process by heat transfer to the surrounding air, which is at 25 °C. What is the net increase in entropy of the water plus surrounding?

2- One kilogram of liquid water is heated from 20 °C to 90 °C. Calculate the entropy change, assuming constant specific heat, and compare the result with that found when using the steam tables.

3- Calculate the change in entropy per kilogram as air is heated from 300 K to 600 K while pressure drops from 400 to 300 kPa Assume (1) Constant specific heat. (2) Variable specific heat.

4- In a reversible process, nitrogen is compressed in a cylinder from 100 kPa and 20 °C to 500 kPa. During this compression process, the relation between pressure and volume is $P\ V^{1.3}$ = const. Calculate the work and heat transfer per kilogram, and show this process on P-V and T-S diagrams.

5- A frictionless piston- cylinder device contains a saturated mixture of water at 100 °C. During a constant pressure process, 600 kj of heat is transferred to the surrounding air at 25 0°C. As a result, part of the water vapor contained in the cylinder condenses. Determine (a) the entropy change of the water and (b) the total entropy generation during this heat transfer process.

6- A 50 kg block of iron casting at 500 K is thrown into a large lake that is at a temperature of 285 K. the iron block eventually reaches thermal equilibrium with the lake water. Assuming an average specific heat of 0.45 kj/kg.k for the iron, determine (a) the entropy change of the iron block, (b) the entropy change of the lake water, (c) the entropy generated during this process.

7- Consider steady heat flow through a 5m*6m brick wall of a house of thickness 30 cm and thermal conductivity 0.69 W/m. °C. On a day when the temperature of the outdoors is 0 °C, the house is maintained at 27 °C. The temperatures of the inner and outer surfaces of the brick wall are measured to be 20 °C and 5 °C, respectively. Determine the rate of heat transfer through the wall, the rate entropy generation in the wall, and the rate of total entropy generation associated with this heat transfer process.

8- Steam at 7 MPa and 450 °C is throttled in a valve to a pressure of 3MPa during a steady-flow process. Determine the entropy generated during this process and check if the increase of entropy principles is satisfied.